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ABSTRACT

Although computers have potential applications in the elementary and secondary physical education curriculum, current usage is minimal when compared to other disciplines. However, present trends indicate a substantial growth in the use of the computer in a supportive role in assisting the teacher in the management of instructional activities. Toward this end, computer programs can help solve problems such as the handling of data and the organization and scheduling of school facilities for physical education classes. Also, the information retrieval process may be used to record supplies maintained in the department. Computer data can also be used to analyze student performance in a particular activity. Athletic simulations of stop action games such as golf, softball, or volleyball are popular with secondary students and allow strategies of play to be tested and investigated for decisions. In addition, programs may be written by students to underscore the teaching of concepts. Many benefits are derived when the student via the program must teach the computer exactly what to do. Here, a necessary transition must be made from mental knowledge and benefits of an activity to the physical engagement of the activity. (WCM)

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COMPUTERS IN PHYSICAL EDUCATION

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I. INTRODUCTION

The computer is described as a machine which assists us in the menial mental tasks thus expanding our abilities and capabilities. The computer is fast, accurate, and stupid while man is slow, inaccurate, and brilliant. Although its application to the "physical" world is not readily apparent, the computer can serve as a viable instructional tool in this process of educating the physical being of each individual student. By the very nature of activities related to physical education, the role of the computer is supportive in nature with respect to the curriculum. Physical education implies physical activity, and normal computer use is not characterized as a physical activity. The purpose of this article is to explore various applications which either could be or are being accomplished using the computer in the physical education curriculum.

When one examines the amount of time spent in a life span of seventy years, some interesting statistics emerge. The average person spends one thirty-fifth (3%) of their life on formal education preparing them for the one-seventh (14%) of their life spent working at some occupation. Figuring in one-third of a lifetime for biological necessities such as sleeping and eating; fully, one-half (50%) of our life is left to discreationary activities and recreation. Thus, there exists a need in the formal education process for preparing students for half of their lives. This need is partially served by physical education and recreation courses offered at both the elementary and secondary levels. In this presentation, discussion will center on computer applications relative to physical education and related recreational activities.

Typically, education in a physical activity incorporates not only the actual play, but instruction on rules, optimal strategies, general feel of play, physical as well as other benefits, and skills development. The computer is not directly involved in the play of the activity, hence it serves a supportive function. In

IR 001 152

the area of developing an understanding of rules, strategies, and benefits the computer can make significant contributions via similar modes of instructional applications used in other areas. Transfer of the learning must take place when the student applies the training to an actual physical activity. Because there does not necessarily exist a direct correlation between the acquisition of intellectual concepts necessary to function in an activity and the actual application of these principles in the participation of the activity, the computer assisted instruction type of uses are more prevalent in other areas than physical education. Knowledge of the skills does not imply the ability to effectively execute skills (acquisition of a kinesthetic sense). In general, strategy execution and skill development areas of instruction are best left for students to be directly involved in the activity as opposed to forced computer usage where the computer is not necessarily the best mode for teaching these facets. Physical education courses provide their own laboratory experience via the physical education facilities thus not needing the "computer lab" as in many other subject areas. However, this does not mean that there do not exist constructive instructional computer uses where the computer is used directly in the physical education curriculum.

II. Role of the Computer in Physical Education

When examining types of computer applications in the physical education curriculum, not all modes of usage are applicable to this field. Both the drill and tutorial uses appear to offer few benefits in this area. Rules for an activity may be learned via computer drill however, the amount of the necessary time utilized to accomplish this for a class will probably be too great to consider this as a viable use. Individualized computer drill on exercises and their physiological benefits can be useful as an instructional means of learning activities which strengthen all areas of the body for maintaining life-long physical fitness. To reiterate, for this instruction to be effective the necessary transition must be

made from the mental knowledge and benefits of the activity to physically doing the activity.

Computer problem-solving uses fall into two categories. Programs which have been written to solve a particular problem may be continually used as the same situation is confronted. These uses require no knowledge of programming by the user. The following is a sample run of a program which generates round robin schedules for an entered number of teams.

```
GET-SSCHDL1
RUN
SCHDL1

ROUND ROBIN SCHEDULE
INPUT # TEAMS?6
 0    1    2    3    4    5
 1    0    3    4    5    2
 2    3    0    5    1    4
 3    4    5    0    2    1
 4    5    1    2    0    3
 5    2    4    1    3    0

PERIOD 1
GAME        HOME AWAY
  1            1    2
  2            5    3
  3            6    4

PERIOD 2
GAME        HOME AWAY
  4            3    1
  5            6    2
  6            4    5

PERIOD 3
GAME        HOME AWAY
  7            1    4
  8            2    3
  9            5    6

PERIOD 4
GAME        HOME AWAY
 10            5    1
 11            4    2
 12            3    6

PERIOD 5
GAME        HOME AWAY
 13            1    6
 14            2    5
 15            3    4

DONE
```

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Other managementtypes of assistance can be offered the physical education teacher such a using the computer to schedule the various school facilities with the physical education classes. Although the computer is not being directly used in the instructional process, it is supporting and assisting the teacher in performing the task of teaching. Additionally, programs may be written by students to underscore the teaching of concepts. Many benefits are derived when the student via the program must teach the computer exactly what to do. An example is included of a student-written bowling scoring program.

```
10  DIM A[25]
20  FOR X=1 TO 23 STEP 2
30  LET A[X]=INT(15*RND(0))
40  IF A[X]<4 OR A[X]>10 THEN 30
50  IF A[X]=10 THEN 110
60  LET A[X+1]=INT(15*RND(0))
70  IF A[X+1]>9 THEN 60
80  IF A[X]+A[X+1]>10 THEN 60
90  NEXT X
100  GOTO 130
110  LET A[X+1]=0
120  GOTO 90
130  PRINT "FRAME","1ST BALL","2ND BALL","SCORE"
140  LET S=0
150  LET X=F=1
160  PRINT F,
170  IF A[X]=10 THEN 270
180  PRINT A[X],
190  IF A[X]+A[X+1]=10 THEN 330
200  PRINT A[X+1],
210  LET S=S+A[X]+A[X+1]
220  PRINT S
230  IF F=10 THEN 360
240  LET X=X+2
250  LET F=F+1
260  GOTO 160
270  PRINT "STRIKE","***",
280  IF A[X+2]=10 THEN 310
290  LET S=S+A[X]+A[X+2]+A[X+3]
300  GOTO 220
310  LET S=S+A[X]+A[X+2]+A[X+4]
320  GOTO 220
330  PRINT "SPARE",
340  LET S=S+A[X]+A[X+1]+A[X+2]
350  GOTO 220
360  IF A[19]=10 THEN 390
370  IF A[19]+A[20]=10 THEN 460
380  GOTO 540
```

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CONTINUED ON NEXT PAGE

```
390  IF A[21]=10 THEN 430
400  IF A[21]+A[22]=10 THEN 510
410  PRINT "EXTRA BALLS:"A[21],A[22]
420  GOTO 540
430  IF A[23]=10 THEN 530
440  PRINT "EXTRA BALLS:  STRIKE",A[23]
450  GOTO 540
460  IF A[21]=10   THEN 490
470  PRINT "EXTRA BALL:"A[21]
480  GOTO 540
490  PRINT "EXTRA BALL:  STRIKE"
500  GOTO 540
510  PRINT "EXTRA BALLS:"A[21],"SPARE"
520  GOTO 540
530  PRINT "EXTRA BALLS:  STRIKE     STRIKE"
540  PRINT
550  PRINT "END OF GAME"
560  END
```

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```
RUN

FRAME          1ST BALL       2ND BALL       SCORE
 1             STRIKE         ***             24
 2             STRIKE         ***             43
 3              4              5              52
 4              8             SPARE           71
 5              9              0              80
 6              8             SPARE           98
 7              8             SPARE          116
 8              8              0             124
 9              5              0             129
 10             8              1             138

END OF GAME

DONE
RUN

FRAME          1ST BALL       2ND BALL       SCORE
 1              8              1              9
 2              5              4              18
 3              5             SPARE           33
 4              5              2              40
 5              6              1              47
 6              4             SPARE           63
 7              6              2              71
 8              9              0              80
 9              9             SPARE           99
 10             9             SPARE          115
EXTRA BALL: 6

END OF GAME

DONE
```

The backbone of many competitive game-type activities to assist in sustaining interest is the myraid of statistics which are maintained. The process of storing, cumulating and calculating data, and printing formatted reports are comfortably handled by the computer. The information received from the data not only may be used for dissemination purposes but for analysis of a student's performance in a particular activity. The following program on individual basketball statistics is part of a package of athletic statistics programs for a variety of activities.

The 16 data items for the respective players are entered in the following order:

3 Defensive categories
3 Neutral categories
3 Minus categories
5 Offensive categories
(Assists, FGM, FGA, FTM, FTA)
2 Time categories
(Quarters, Games)

The three specific items to be measured in the first three general categories are left to the discretion of the user.

Calculated Statistics are derived in the following manner:

D = Total Defense = D1 + D2 + D3
N = Total Neutral = N1 + N2 + N3
M = Total Minus = M1 + M2 + M3
O = Total Offense = Assists (A) + Points (P)
FG% = FGM/FGA * 100
FT% = FTM/FTA * 100
P = Points = 2 * FGM + FTM
P/G = Points per game
D/Q = Defense per quarter
N/Q = Neutral per quarter
O/Q = Offense per quarter
+/Q = Plus per quarter = (D + N + O)/Q
-/Q = Minus per quarter = M/Q
T/Q = Total per quarter = (D + N + O - M)/Q

Team Totals for each item are calculated by taking the sum of all the players.

```
GET-SSTIX
APP-SSTIX11
RUN-180
STIX

# PLAYERS?2
# DATA ITEMS?16
OPTION?1
NAME FILE?NONE
 1     ?3,2,3,3,5,2,1,1,2,3,4,12,0,0,3,1
 2     ?5,2,4,1,0,1,2,2,3,1,12,23,13,15,8,2
OPTION?4
NAME FILE?NONE
```

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BASKETBALL STATISTICS

	DEFENSE				NEUTRAL				MINUS			
#	D1	D2	D3	D	N1	N2	N3	N	M1	M2	M3	M
1	3	2	3	8	3	5	2	10	1	1	2	4
2	5	2	4	11	1	0	1	2	2	2	3	7
TEAM	8	4	7	19	4	5	3	12	3	3	5	11

#	A	FGM	FGA	FG%	FTM	FTA	FT%	P	P/G	O
1	3	4	12	33.3	0	0	0.0	8	8.00	11
2	1	12	23	52.2	13	15	86.7	37	18.50	38
TEAM	4	16	35	45.7	13	15	86.7	45	22.50	49

#	NAME	Q	G	D/Q	N/Q	O/Q	+/Q	-/Q	T/Q
1		3	1	2.67	3.33	3.67	9.67	1.33	8.33
2		8	2	1.37	0.25	4.75	6.37	0.88	5.50
TEAM		8	2	2.37	1.50	6.12	10.00	1.37	8.62

```
OPTION?10

DONE
```

An information retrieval process may be used for the storing, accessing, and examining of large quantities of data. An inventory data file sample is included to illustrate how accurate records of the numerous supplies may be maintained in the physical education department. This may be done on an interactive basis using the same programs designed for storing and analyzing survey results in a social science class. The key to this use is the coding of the data so that it may be extracted in a meaningful manner.

INVENTORY CODING

FILE: INVENT - INFORMATION RETRIEVAL

NAME	CATEGORY	USAGE	LOCATION	QTY.	YEAR	CONDITION
Article M P (10)	1 Baseball	1 MP	1 PE Storeroom	0-98	0-98	0 Shot
W A	2 Softball	2 WP	2 A Storeroom			1 Poor
	3 Tennis	3 MWP	3 M Locker			2 Fair
	4 Golf	4 MA	4 W Locker			3 Good
	5 Basketball	5 WA	5 Coaches Office			4 New
	6 Volleyball	6 MWP				
	7 Handball	7 REC				
	8 Hockey					
	9 Football					
	10 Soccer					

INVENTORY

FILE: INVENT-INFORMATION RETRIEVAL

20 Character Name Maximum
6 Data Categories
ALPHABETIZED

NAME	CATEGORY	USAGE	LOCATION	QUANTITY	YEAR	CONDITION
Basketballs WP R	5	2	4	8	69	2
Basketballs WP L	5	2	1	2	72	4
Basketballs MP R	5	1	3	10	70	2
Basketballs MA L1	5	4	2	20	70	3
Basketballs MA L2	5	4	5	3	73	4
Basketballs WA L	5	5	4	24	72	3
Pucks	8	4	2	36	71	3
Soccer Balls REC	10	7	1	8	66	2
Soccer Balls MA	10	4	2	15	20	2
Basketballs REC R	5	7	1	7	63	0
Tennis Balls P	3	3	1	40	68	1
Tennis Balls A	3	6	2	25	71	2
Golf Balls REC	4	7	1	0	0	0
Golf Balls A	4	6	5	48	73	4
Softballs P R	2	3	1	16	67	2
Footballs MP R	9	1	1	12	66	2
Baseballs MA L1	1	4	2	30	71	2
Footballs MA R	9	4	2	10	69	3
Baseballs MA L2	1	4	5	24	73	4
Footballs MA L	9	4	5	6	73	4
Volleyballs REC R	6	7	1	9	65	2
Handballs REC R	7	7	5	6	60	3
Volleyballs WA L	6	5	4	12	71	3

```
GET-$INFRET
RUN
INFRET

WHAT IS THE NAME OF YOUR INFORMATION FILE?INVENT

OPTION?SORT

SORT ON WHICH DATA NUMBER?5
 0            GOLF BALLS REC
 60           HANDBALLS REC R
 63           BASKETBALLS REC R
 65           VOLLEYBALLS REC R
 66           SOCCER BALLS REC
 66           FOOTBALLS MPE R
 67           SOFTBALLS PE R
 68           TENNIS BALLS PE
 69           FOOTBALLS MA R
 69           BASKETBALLS WPE R
 70           BASKETBALLS MPE R
 70           SOCCER BALLS MA
 70           BASKETBALLS MA L1
 71           TENNIS BALLS A
 71           PUCKS
 71           BASEBALLS MA L1
 71           VOLLEYBALLS WA L
 72           BASKETBALLS WPE L
 72           BASKETBALLS WA L
 73           BASEBALLS MA L2
 73           GOLF BALLS A
 73           FOOTBALLS MA L
 73           BASKETBALLS MA L2


 OPTION?STOP

 DONE
```

Athletic simulations are very popular with many secondary students. The competitive and accurate models which approximate a game used in many simulations provide a wealth of recreational activities which stimulate and challenge the users. The best activities for simulations are stop-action in nature; by this we mean activities which have a natural pause in their pattern of play such as golf, softball, or volleyball, at which time a decision may be entered. Various strategies of play may be tested using the simulation in an investigation for a best set of decisions. The following simulation is of an 18-hole golf course of which only the first hole of play is shown in the sample.

```
GET-*GOLF
RUN
GOLF

WELCOME TO THE TIES TIMESHARING 18 HOLE CHAMPIONSHIP COURSE
TO GET A DESCRIPTION OF CLUBS, ETC. TYPE 0 FOR A CLUB NK. WHEN REQUESTED

WHAT IS YOUR HANDICAP ?9
OH-OH, A HOT SHOT!
DIFFICULTIES AT GOLF INCLUDE:
   0=HOOK, 1=SLICE, 2=POOR DISTANCE, 4=TRAP SHOTS, 5=PUTTING
WHICH IS YOUR WORST ?4

READY TO GO,?YES
YOU ARE AT TEE OFF HOLE 1     , DISTANCE 361  YARDS PAR 4

ON YOUR RIGHT IS ADJACENT FAIRWAY.
ON YOUR LEFT IS ADJACENT FAIRWAY.

WHAT CLUB DO YOU WANT ?0
```

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```
HERE'S YOJR BAG OF CLUBS

  WOODS (FULL S#ING ONLY)
     1   DRIVER
     2   BRASSIE
     3   SPOJN

  IRONS (FULL S#ING ONLY)
     12   T#O IRON
     .
     .
     19   NI'HE IRON

  IRONS (LES; THEN FUL. S#ING)
     22   T#O IRON - PARTIAL S#ING
     .
     .
     29   NINE IRON - PARTIAL S#ING


WHEN YOJ REACH THE GRE'N IT #ILL BE ASSUMED THAT YOU ARE
USING A PJT'ER. THE PJTT POTENCY NO. REFERS TO THE STRENGTH
WITH #HICH THE BAL'. IS PJTTED. JSE NJMBERS GREATER THAN
ZERO, INCREASING THE NJMBER FOR GREATER DISTANCE.

YOJ #IL. BE ASKED FOR 'PERCENT FJLL S#ING' ON CLJBS 22-29.
THIS SHJJLD BE A NJMBER FROM 1 TO 9 .
-------------------------------------------------------------

WHAT CLJB DO YOJ #A'NT ?1

SHOT #ENT 251  YARDS - IS 110  YARDS FROM HOLE.
BALL IS 1     YARDS OFF LINE IN FAIR#AY.


WHAT CLJB DO YOJ #ANT ?19
TO) MJCH CLJB. YOJ ARE PAST HOLE.
ON GREEN 60    FEET FROM PIN. PJT POTENCY NJMBER ?7
PJTT SHORT.
ON GREEN 28    FEET FROM PIN. PJT POTENCY NJMBER ?3
PJTT SHORT.
ON GRE N 15    FEET FROM PIN. PJT POTENCY NJMBER ?3
PJTT SHORT.
ON GREEN 2     FEET FROM PIN. PJT POTENCY NJMBER ?1
YOJ H*O*L*E*D IT

YOJR SCORE ON HOLE 1     #AS 6
```

Many supportive curriculum computer applications are classified in the general area of management. The computer, although not directly used by the student, is used by the teacher as an assistant in handling data and organizing classes. This appears to be the general area where the computer can play a significant role in the physical education curriculum. To illustrate these types of applications, two examples will be considered.

Many schools participate in the National Youth Fitness Testing Program sponsored by AAHPER. A time-share computer program was written which stores the test results, assigns percentile ranks to these results, computes a ranking mean as an index of overall fitness, and prints both a National Youth Fitness Report Card for each student and a teacher summary report for each class.

The following is a sample report card printed by the computer:

STUDENT NAME DOE JOHN SCHOOL NORTH CLASS 7 STUDENT NO.

SEM.	SHUTTLE RUN		SIT UPS 2 MINUTES		PULL UPS		BROAD JUMP		50 YARD DASH		SOFT BALL THROW		600 YARD RUN	
	SCORE	%	SCORE	%	SCORE	%	SCORE	%	SCORE	%	SCORE	%	SCORE	%
1	9.9	90	70	95	6	85	7.00	95	7.0	90	147	80	1.59	90
2	9.8	95	73	95	6	85	6.11	95	6.9	90	153	85	1.54	90

FIRST SEMESTER MEAN = 89
SECOND SEMESTER MEAN = 91

Physical education teachers have been leaders in the individualized approach to develop requisite skills for effective participation in an activity. The problem of grouping students for work on particular skills is often time consuming. However, the computer can offer the beleaguered teacher valuable assistance in the organization and management of a skills development period. Such a program does exist called ILA (Individualized Learning Activities). Objectives or skills are identified and status on each for individual students are monitored and entered into the computer. The teacher may then have the computer locate students needing work on a particular skill and group them together, thus scheduling students for a skills development session.

```
GET-ILA
RUN
ILA
UNIT NAME?JOHNS
SØ = 52  S1 = 2  TØ = 11
>ROS
NO.    NAME                 1  ·5   1Ø   15   2Ø
 1  AHRENS RICHARD          •••••     •    •    •
 2  ANDERSON MABEL               •    • ••••    •
 3  GREEN TIM                    •    •••••••••••••
 4  JOHNSON JAMES           ••••    • •  •    •
 5  JONES JONATHAN          ••••••••••     •    •
 6  MACK BONNIE             ••• ••••  • ••••    •
 7  MILLER MIKE                  •    •    •    •
 8  RUTZ ELIZABETH          ••••      •    •    •
 9  SCHMIDT JENNIFER             •    •    •    •
1Ø  SMITH JOHN                   •    •   ••   •••
11  THOMPSON NORMAN         •••       •    •    •

>ADD-C,1,ON,14
>ADD-C,2,ON,6
>SIZ
GROUP  SIZE
  1      4
  2      4
  3      3
>LIS
GROUP 1                    GROUP 2                    GROUP 3
  2  ANDERSON MABEL          4  JOHNSON JAMES           1  AHRENS RICHARD
  3  GREEN TIM               5  JONES JONATHAN          7  MILLER MIKE
  6  MACK BONNIE             8  RUTZ ELIZABETH          9  SCHMIDT JENNIFER
 1Ø  SMITH JOHN              11  THOMPSON NORMAN
```

III. SUMMARY

Current usage is minimal in physical education when compared to other disciplines, however, present trends indicate a substantial growth in the use of the computer in a supportive role in assisting the teacher in the management of instructional activities. There exists a need for the development of programs, and materials which use the computer effectively in the physical education curriculum, and the subsequent sharing of these ideas via articles and conference presentations.

NOTE: The programs used to illustrate various modes of computer usage were run on one of the Hewlett Packard 2000C'/F Timeshare Systems at TIES. TIES (Total Information for Educational System) is a regional Minnesota cooperative network of thirty-four elementary/secondary and vocational-technical school districts providing data processing services for administrative, instructional, and research applications utilizing an on-line integrated data base.

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